

Amendments to the Claims:

The listing of claims below replaces all previous versions of the claims in this application.

1. (Original) A method of drilling a bore hole, comprising:
alternating between rotary drilling and sliding drilling using a steerable drilling motor while a drill bit remains in substantially continuous contact with a bottom of said bore hole, said steerable drilling motor being connected by a drill string to a surface drilling location.
2. (Original) The method as claimed in claim 1, further comprising:
rotating said drill string in said bore hole at a first speed of rotation.
3. (Original) The method as claimed in claim 2, further comprising:
advancing said drill string in said bore hole at a rate selected to substantially maintain a target drilling fluid pressure.
4. (Previously Amended) The method as claimed in claim 2, further comprising:
slowing rotation of said drill string to a second speed of rotation.
5. (Original) The method as claimed in claim 4, further comprising:
stopping rotation of said drill string when said steerable motor is at a first selected angle with respect to a target tool face angle; and
stopping advancing said drill string.
6. (Original) The method as claimed in claim 5, further comprising:
advancing said drill string when said steerable drilling motor is at a second selected angle with respect to said target tool face angle.
7. (Previously Amended) The method as claimed in claim 6, further comprising:

maintaining the second_selected angle of said steerable drilling motor with respect to said target tool face angle.

8. (Original) The method as claimed in claim 7, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises:

adjusting at lease one of a rate of release of said drill string into said well bore, and an amount of rocking said drill string in a first direction and in a second direction so as to maintain said drilling fluid pressure at a selected value.

9. (Original) The method as claimed in claim 7, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: rotating said drill string.

10. (Original) The method as claimed in claim 7, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: applying a selected torque to said drill string.

11. (Original) The method as claimed in claim 7, further comprising: stopping advancing said drill string; and when tool face angle of said steerable drilling tool moves a selected amount, rotating and advancing said drill string.

12. (Previously Amended) The method as claimed in claim 6, further comprising: commencing rocking said drill string when said steerable motor is at the second_selected angle with respect to the target tool face angle.

13. (Original) The method as claimed in claim 12, wherein said rocking comprises: rotating said drill string in a first direction until a first torque magnitude is reached at said surface location; and rotating said drill string in a second direction opposite said first direction until a second torque magnitude is reached at said surface location.

14. (Original) The method as claimed in claim 13, wherein said first and second torque magnitudes are less than a torque required to rotate said steerable drilling motor in the well bore.

15. (Original) The method as claimed in claim 13, further comprising: maintaining the tool face angle of said steerable drilling motor at said target tool face angle.

16. (Original) The method as claimed in claim 15, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: adjusting at least one of a rate of release of said drill string into said well bore, and the first and the second selected torque magnitudes so as to maintain a drilling fluid pressure at a selected value.

17. (Original) The method as claimed in claim 15, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: adjusting one of said first and second torque magnitudes.

18. (Original) The method as claimed in claim 17, wherein adjusting one of said first and second magnitudes includes: adjusting said first magnitude if said tool face angle of said steerable drilling motor differs from said target tool face angle in said second direction; and, adjusting said second magnitude if said tool face angle of said steerable drilling motor differs from said target tool face angle in said first direction.

19. (Original) The method as claimed in claim 15, including: stopping advancing said drill string and said rocking; and when tool face angle of said steerable drilling tool moves a selected angle, rotating and advancing said drill string.

20. (Previously Amended) A method of drilling a bore hole, comprising:

rotating and advancing a drill string having a steerable motor connected thereto in said bore hold, said drill string having a bit at a bottom end thereof, said bit being in contact with a bottom of said well bore, thereby drilling in a rotary mode; and

after drilling in said rotary mode, stopping rotation of said drill string and continuing to advance said drill string with said bit in substantially continuous contact with said bottom, thereby drilling in a sliding mode.

21. (Original) The method as claimed in claim 20, wherein said rotating and advancing comprises: rotating said drill string in said bore hole at a first speed of rotation.

22. (Original) The method as claimed in claim 21, wherein said rotating and advancing comprises: advancing said drill string in said bore hole at a rate selected to maintain a target drilling fluid pressure.

23. (Original) The method as claimed in claim 22, wherein said stopping said rotation comprises: slowing rotation of said drill string to a second speed of rotation while maintaining said target drilling fluid pressure differential.

24. (Original) The method as claimed in claim 23, wherein said stopping rotation comprises: stopping rotation of said drill string when said steerable motor is at a first selected angle with respect to a target tool face angle; and, temporarily stopping advancing said drill string while said bit remains in contact with said bottom.

25. (Original) The method as claimed in claim 24, comprising: advancing said drill string when said steerable drilling motor is a second selected angle with respect to said target tool face angle.

26. (Original) The method as claimed in claim 25, comprising: maintaining said steerable drilling motor at said target tool face angle.

27. (Original) The method as claimed in claim 26, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: adjusting at least one of a rate of release of said drill string and an amount of rocking of said drill string in a first direction and in a second direction so as to maintain said drilling fluid pressure substantially constant.

28. (Original) The method as claimed in claim 26, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: rotating said drill string.

29. (Original) The method as claimed in claim 26, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: applying a selected torque to said drill string.

30. (Original) The method as claimed in claim 20, further comprising: after drilling in said sliding mode, rotating and advancing said drill string in said bore hole with said bit in substantially continuous contact with said bottom, thereby drilling in said rotary mode.

31. (Original) The method as claimed in claim 30, further comprising: after drilling in said sliding mode, temporarily stopping advancing said drill string with said bit in contact with said bottom; and rotating and advancing said drill string when said tool face angle of said steerable drilling tool moves a selected angle.

32. (Original) The method as claimed in claim 20, further comprising: stopping rotation of said drill string during said rotary mode when said steerable motor is at a selected angle with respect to a target tool face angle and commencing rocking said drill string in said sliding mode.

33. (Original) The method as claimed in claim 32, wherein said rocking comprises: rotating said drill string in a first direction until a first torque magnitude is reached at said surface location; and, rotating said drill string in a second direction opposite said first direction until a second torque magnitude is reached at said surface location.

34. (Original) The method as claimed in claim 33, wherein said first and second torque magnitudes are less than the torque required to rotate said steerable drilling motor in said well bore.

35. (Original) The method as claimed in claim 33, further comprising: maintaining said steerable drilling motor at said target tool face angle in said sliding mode.

36. (Original) The method as claimed in claim 35, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: adjusting at least one of a rate of release of said drill string, said first torque magnitude and said second torque magnitude so as to maintain said drilling fluid pressure differential substantially constant.

37. (Original) The method as claimed in claim 35, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: adjusting one of said first and second torque magnitudes.

38. (Original) The method as claimed in claim 37, wherein adjusting one of said first and second magnitudes comprises: adjusting said first magnitude if said tool face angle of said steerable drilling motor differs from said target tool face angle in said second direction; and, adjusting said second magnitude if said tool face angle of said steerable drilling motor differs from said target tool face angle in said first direction.

39. (Original) The method as claimed in claim 32, further comprising: after drilling in said sliding mode, rotating and advancing said drill string in said bore hole with said bit in substantially continuous contact with said bottom, thereby drilling in said rotary mode.

40. (Original) The method as claimed in claim 39, further comprising: stopping advancing said drill string and said rocking; and rotating and advancing said drill string when tool face angle of said steerable drilling tool moves a selected angle.

41. (Previously Amended) A method of drilling a bore hole, comprising:
advancing a drill string having a steerable drilling motor connected thereto in said bore hole, said steerable drilling motor having a tool face angle, said drill string having a bit at a

bottom end thereof, said bit being in substantially continuous contact with a bottom of said well bore, thereby drilling in a sliding mode;

rotating said drill string and continuing to advance said drill string with said bit in substantially continuous contact with said bottom after drilling in said sliding mode, thereby drilling in a rotary mode; and

rocking said drill string in said sliding mode.

42. (Original) The method as claimed in claim 41, further comprising: maintaining said steerable drilling motor at a target tool face angle when drilling in said sliding mode.

43. (Original) The method as claimed in claim 42, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: adjusting at least one of a rate of release of said drill string and an amount of rotation of said drill string in a first direction and a second direction so as to maintain a drilling fluid pressure substantially constant.

44. (Original) The method as claimed in claim 42, wherein maintaining said steerable drilling motor at said target tool face angle comprises: rotating said drill string to a selected surface torque value.

45. (Original) The method as claimed in claim 42, wherein maintaining said steerable drilling motor at said target tool face angle comprises: applying a selected torque to said drill string.

46. (Original) The method as claimed in claim 41, further comprising: after drilling in said sliding mode, temporarily stopping advancing said drill string with said bit in contact with said bottom; and rotating and advancing said drill string in said rotary mode when said tool face angle of said steerable drilling tool moves a selected angle.

47. (Canceled)

48. (Previously Amended) The method as claimed in claim 41, wherein said rocking comprises: rotating said drill string in a first direction until a first torque magnitude is reached at said surface location; and rotating said drill string in a second direction opposite said first direction until a second torque magnitude is reached at said surface location.

49. (Original) The method as claimed in claim 48, wherein said first and second torque magnitudes are less than the torque required to rotate said steerable drilling motor.

50. (Original) The method as claimed in claim 48, further comprising: maintaining said steerable drilling motor at said target tool face angle during said sliding mode.

51. (Original) The method as claimed in claim 50, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: adjusting at least one of said first torque magnitude and said second torque magnitude so that said drilling fluid pressure differential remains substantially constant.

52. (Currently Amended) The method as claimed in claim 50, wherein maintaining said steerable drilling motor at said target tool face angle comprises: adjusting at least one of said first ~~and torque magnitude, said~~ second torque magnitude[[s]] an angular displacement in said first direction and an angular displacement in said second direction.

53. (Currently Amended) The method as claimed in claim 52, wherein ~~the~~ adjusting ~~one of said first and second magnitudes~~ comprises: adjusting at least one of said first magnitude ~~and said angular displacement in said first direction~~ if said tool face angle of said steerable drilling motor differs from said target tool face angle in said second direction; and, adjusting at least one of said second magnitude ~~and said angular displacement in said second direction~~ if said tool face angle of said steerable drilling motor differs from said target tool face angle in said first direction.

54. (Original) The method as claimed in claim 48, including: temporarily stopping advancing said drill string; stopping said rocking routine; and rotating and advancing said drill string in said rotary mode when tool face angle of said steerable drilling tool moves a selected angle.

55. (Original) A method of directional drilling, which comprises:

- (a) orienting a steerable drilling motor at a target tool face angle, said steerable drilling motor being connected by a drill string to a surface drilling location;
- (b) rocking said drill string by:
 - (i) rotating said drill string at said surface location in a first direction until a first torque magnitude is reached at said surface location substantially without changing a tool face angle of said steerable drilling motor; and
 - (ii) rotating said drill string at said surface location in a second direction opposite said first direction until a second torque magnitude is reached without changing the face angle of said steerable drilling motor; and
- (c) maintaining the tool face angle of said steerable drilling motor at said target tool face angle by adjusting at least one of said first and second torque magnitudes for least one drill string rotation in the first and second direction.

56. (Original) The method as claimed in claim 55, wherein adjusting one of said first and second magnitudes comprises: adjusting said first magnitude if said tool face angle of said steerable drilling motor differs from said target tool face angle in said second direction; and, adjusting said second magnitude if said tool face angle of said steerable drilling motor differs from said target tool face angle in said first direction.

57. (Original) The method as claimed in claim 55, wherein adjusting one of said first and second magnitudes comprises: measuring a drilling fluid pressure; and adjusting at least one of the first and second magnitudes to maintain the drilling fluid pressure substantially constant.

58. (Previously Amended) A directional drilling system, which comprises:
a steerable drilling motor;

a steering tool operatively coupled to said steerable drilling motor, said steering tool being adapted to produce a tool face angle signal;
a drill string coupled to said steerable drilling motor;
a drill string torque sensor operatively coupled to said drill string, said torque sensor being adapted to produce a drill string torque signal;
means for rotating said drill string at a surface location;
a controller for operating said rotating means to rotate said drill string cyclically back and forth in a first direction until a first torque magnitude is reached and then in a second direction opposite said first direction until a second torque magnitude is reached; and,
a bump control for adjusting at least one of said first and second torque magnitudes for at least one cycle.

59. (Original) The system as claimed in claim 58, wherein said bump control includes for increasing said first and second magnitudes by user specified amounts.

60. (Previously Amended) A method for directional drilling, comprising:

advancing a drill string including a bit and a drilling motor thereon along a bore hole, the drilling motor oriented at a selected tool face angle;

rotating the drill string in a first direction until a first torque magnitude is reached;
rotating the drill string in a second direction opposite to the first direction until a second torque magnitude is reached;

reducing a rate of release of the drill string into the bore hole;

repeating rotating the drill string in the first direction to a torque value increased by a selected amount above the previous torque magnitude in the first direction; and

repeating the rotating the drill string in the second direction, rotating attain in the first direction and increasing the torque until the drill string rotates substantially continuously in the first direction.

61. (Original) The method of claim 60 further comprising decreasing the torque in the second direction by a selected amount each time the drill string is rotated in the second direction.

62. (Canceled)

63. (New) A method of drilling a bore hole, comprising:

advancing a drill string having a steerable drilling motor connected thereto in said bore hole, said steerable drilling motor having a tool face angle, said drill string having a bit at a bottom end thereof, said bit being in substantially continuous contact with a bottom of said well bore, thereby drilling in a sliding mode;

rocking said drill string in said sliding mode; and.
maintaining said steerable drilling motor at a target tool face angle when drilling in said sliding mode.

64. (New) The method as claimed in claim 63, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises: adjusting at least one of a rate of release of said drill string and an amount of rotation of said drill string in a first direction and a second direction so as to maintain a drilling fluid pressure substantially constant.

65. (New) The method as claimed in claim 63, wherein maintaining said steerable drilling motor at said target tool face angle comprises rotating said drill string to a selected surface torque value.

66. (New) The method as claimed in claim 63, wherein said rocking comprises: rotating said drill string in a first direction until a first torque magnitude is reached at said surface location; and rotating said drill string in a second direction opposite said first direction until a second torque magnitude is reached at said surface location.

67. (New) The method as claimed in claim 66, wherein said first and second torque magnitudes are less than the torque required to rotate said steerable drilling motor.

68. (New) The method as claimed in claim 63, wherein maintaining said tool face angle of said steerable drilling motor at said target tool face angle comprises adjusting at least one of said first torque magnitude and said second torque magnitude so that said drilling fluid pressure differential remains substantially constant.

69. (New) The method as claimed in claim 63, wherein maintaining said steerable drilling motor at said target tool face angle comprises: adjusting at least one of said first torque magnitude, said second torque magnitude an angular displacement in said first direction and an angular displacement in said second direction.

70. (New) The method as claimed in claim 69, wherein the adjusting comprises: adjusting at least one of said first magnitude and said angular displacement in said first direction if said tool face angle of said steerable drilling motor differs from said target tool face angle in said second direction; and, adjusting at least one of said second magnitude and said angular displacement in said second direction if said tool face angle of said steerable drilling motor differs from said target tool face angle in said first direction.